



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4
SAM NUNN
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA GEORGIA 30303-8960

November 8, 2010

Mr. Charles P. Nicholson
NEPA Manager
Tennessee Valley Authority
400 West Summit Hill Drive WT 11C
Knoxville, TN 37902

Subject: EPA NEPA Review Comments on TVA's DEIS for the "Integrated Resource Plan, TVA's Environmental and Energy Future"; General Tennessee Valley (TN, AL, MS, KY, GA, NC, VA); CEQ No. 20100379; ERP No. TVA-E09815-KY

Dear Mr. Nicholson:

The U.S. Environmental Protection Agency (EPA) has reviewed the subject Tennessee Valley Authority (TVA) Draft Environmental Impact Statement (DEIS) in accordance with our responsibilities under Section 102(2)(C) of the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act. The IRP provides options (future condition scenarios, alternative planning strategies, and resource planning portfolios) for TVA's future generation of electricity to sustainably supply the Tennessee Valley's projected need for power with a 15% reserve margin.

In the mid-1990s, EPA had provided comments on TVA's last energy planning IRP EIS (*Energy Vision 2020: EV2020*). Once final, the new IRP would supersede the adopted portfolios of EV2020 through 2029. We commend TVA for its overall development of a comprehensive energy plan and EIS and, specifically, for strategic planning that de-emphasizes conventional coal and pursues less polluting power generation strategies. We also appreciate TVA's introduction of the EIS to us in a presentation at our EPA offices in Atlanta on July 13, 2010.

Accompanying the IRP DEIS was a separate Draft IRP document. While we have concentrated on the NEPA review and comment of the DEIS, we have also provided some review comments on the Draft IRP. Our comments are provided for TVA's consideration during its development of the Final EIS (FEIS) and the Final IRP.

Overview

Currently, TVA's 2010 power capacity of 37,000 MW primarily consists of coal-fired and nuclear energy resources. Within the next few years, TVA plans to bring online the 880-MW John Sevier Combined Cycle (CC) plant and the 1,180-MW Unit 2 of the Watts Bar Nuclear Plant. Coal-fired generation capacity would be reduced for all

IRP strategies, while reliance on other strategies would increase. Although not without impacts, the strategies proposed by TVA would reduce emissions of criteria air pollutants (National Ambient Air Quality Standards: NAAQS), air toxics (Hazardous Air Pollutants: HAPs) and greenhouse gases (GHGs) compared to actual conventional coal strategies.

EPA Expectations

Relative to TVA's future electricity generation, EPA's main concerns center on air quality, water quality/quantity and climate change effects. From our perspective, EPA would support an emphasis on demand-side reductions (increased technological efficiency and conservation incentives) to reduce the need for power; increased development of renewable ("green") power using diverse traditional and emerging generators¹; additional nuclear capacity using state-of-the-art reactor technologies; increased use of natural gas and clean coal fossil fuel technologies²; decommissioning ("layups") and repowering of traditional coal power plants; reduced water consumption technologies and increased waste heat reuse designs; and power purchases (as needed) from sources which minimize environmental impacts while TVA's own capacities from such sources is maximized. These generation strategies could increase customer efficiency/conservation and green power capacity, reduce the volume of air emissions including GHGs such as CO₂ (in terms of CO₂ equivalents: CO₂e) and reuse or sequester generated CO₂; continue to make use of domestic natural gas resources as well as domestic coal resources through clean coal technologies; minimize water consumption required for cooling water and the volume of thermal effluent discharged; minimize the need to transmit electricity and transport feedstocks through strategically locating generators close to users where possible; and other benefits attendant with power industry advances that can be expected over the next 20 years.

Planning Options

TVA considered six conditions (Scenarios 1-6) for future power generation as well as re-considering their current planning approach (Scenario 7). These future condition scenarios are that: 1) the economy recovers dramatically; 2) the environmental focus is a national priority; 3) there will be a prolonged economic malaise; 4) there will be a game-changing technology; 5) there will be a reduced dependence on foreign energy sources; and 6) carbon regulation will create an economic downturn. Of these, we suspect that Scenario 5, and possibly 4, appear the most likely to eventuate. However, based on similarities in capacity expansion plans, TVA paired Scenarios 1 with 4, 2 with 5, and 3 with 6, with 7 being considered somewhat unique. Only Scenarios 1, 2, 3 and 7 were retained after DEIS pairing and examination (pg. 156).

¹ For examples, efficient hydropower generation and development of wind and solar (conventional photovoltaic and solar concentration technologies) and possibly current/wave energy, where appropriate. EPA recognizes that availability of such resources, especially wind and solar, is uneven due to the Tennessee Valley's meteorology and topography.

² For examples, Combined Cycle (CC) and Combined Turbine (CT) technologies for natural gas and Integrated Gasification Combined Cycle (IGCC) technology for clean coal.

Five planning strategy alternatives were also considered: A) limited change in the current resource portfolio; B) baseline plan resource portfolio (No Action); C) diversity focused resource portfolio; D) nuclear focused resource portfolio; E) EEDR (energy efficiency and demand response) and renewables focused portfolio. These were evaluated under the retained Scenarios 1, 2, 3 and 7 (Tables 6-4 to 6-6). Although TVA did not identify a preferred alternative strategy, alternatives A and D were eliminated, while B, C and E were further considered.

For each scenario of a planning strategy alternative, a 20-year resource plan (portfolios) was developed. A total of 35 portfolios were prepared to find an optimum resource option to meet the power generation needs over the 20-year planning period.

EPA agrees with the TVA elimination of a strategy with only limited change (Strategy A), since it would likely not be effective enough over the next 20 years since renewables and other emerging technologies would not be sufficiently emphasized. Similarly, the current baseline plan (Strategy B) would likely also not be adequate but as the No Action Alternative, would be carried forward in the EIS consistent with NEPA. The TVA-eliminated nuclear focused strategy (Strategy D) may also be too oriented toward one generating technology. We further agree that TVA-retained strategy planning action alternatives E and C both have attributes for long-term implementation since they both reduce conventional coal generation and increase renewables, natural gas and nuclear capacities. We note from Tables 6-5 and 6-6 that Strategy E proposes a cumulative reduction of 4,730 MW of fossil fuel layups and elevated capacities for renewables (to 1,157 MW) and EEDR (to 6,043 MW), while Strategy C proposes such elevations at a lower capacity (3,252 MW (layups); 954 MW (renewables); 4,638 MW (EEDR)).³

Air Quality Impacts

Air quality impacts from GHGs, criteria air pollutants and HAPs are addressed in detail in the enclosed *Detailed Comments*. Specific EPA recommendations regarding air quality impacts are provided in this enclosure and are also summarized below.

EPA Recommendations

Our recommendations for the Final IRP and FEIS consist of an overall NEPA recommendation for alternatives (planning options) and several recommendations specific to air quality.

³ The FEIS should disclose the percentage of TVA's grid capacity generated from renewables for Strategies B, C and E. We note that states having adopted a Renewable Portfolio Standard (RPS) require that a range of 8-40% of their electricity be generated by renewable sources. Although there currently is no Federal RPS, EPA would support an aggressive TVA emphasis on renewables for the IRP planning period.

* *Alternatives*: Based on the information provided in the DEIS, EPA prefers elements of alternative planning strategies E and C, with emphasis on E since it maximizes renewable power implementation and a reduction in conventional coal plants under the four scenarios reviewed (and in fact appears to replace capacity lost by coal layouts with the addition of renewables capacity: pp. S-11, S-12). Strategy C is environmentally attractive by offering a diversified approach to power generation (e.g., includes IGCC in 2025 whereas strategy E does not) which allows for greater flexibility over the planning period and may (in the case of IGCC) continue to utilize domestic coal supplies. As such, EPA supports elements of both strategies that promote greater emphasis on diversity in power generation, renewables, customer efficiency/conservation, and use of cleaner technology for carbon-based resources. We also recommend that the rationale for eliminating Scenarios 4-6 be further discussed in the FEIS.

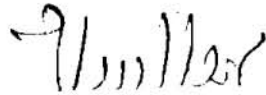
* *Air Quality* – Several recommendations on air quality impacts are detailed in the enclosure. Topics of some of these specific recommendations include: 1) documenting the effects of changing climate on TVA power production; 2) use of CO₂ as a surrogate for emissions reductions for other pollutants; 3) disclosure of the true GHGs emissions associated with nuclear power; 4) acknowledgement of the Council on Environmental Quality's (CEQ) draft guidance on GHGs analyses in NEPA reviews as well as completion of any already relevant assessments; 5) re-evaluation of the literature to ensure accuracy in stated values; 6) consideration of potential HAPs emitted by a TVA facility; 7) discussion of the PM_{2.5} NAAQS regarding attainment, and 8) discussion of types of on-site mitigation at power generation facilities that are in addition to the less-air-pollutant-intensive generation methods.

EPA DEIS Rating

EPA commends TVA for its overall development of a comprehensive energy plan and EIS that de-emphasizes conventional coal and pursues less polluting power generation strategies over the 20-year planning period. However, TVA has not yet identified (pg. 157) an alternative planning strategy in the DEIS, and TVA's power generation approach for the next planning period remains unclear. EPA therefore rates this DEIS as an "EC-2" (Environmental Concerns, with additional information requested) and recommends that strong consideration be given to an alternative similar to planning strategy E, modified to give greater emphasis on diversity in power generation, renewables, customer efficiency/conservation, and use of cleaner technology for carbon-based resources. Regarding our request for additional information, we recommend clarification of air quality information described in the enclosed *Detailed Comments*.

EPA appreciates the opportunity to review this DEIS. Should you have questions on our comments, please contact Chris Hoberg of my staff at 404/562-9619 or hoberg.chris@epa.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "H. Mueller".

Heinz J. Mueller, Chief
NEPA Program Office
Office of Policy and Management

Enclosure: *Detailed Comments*

DETAILED COMMENTS

Air Quality Comments

DRAFT INTEGRATED RESOURCE PLAN (IRP) COMMENTS

1. **Figure 5-2, Key Uncertainties.** While discussed in more detail in the DEIS, we recommend that Figure 5-2 in the Final IRP include, as a key uncertainty, the impact of a changing climate on TVA's ability to provide low-cost reliable energy into the future. For example, how will increasing surface temperature affect summer peak demand (and thus, the prediction of resource needs)?
2. **Page 91, Monte Carlo Simulation.** The document describes the Monte Carlo analysis as having employed only 72 iterations to describe the uncertainty associated with each of the portfolios. A Monte Carlo analysis typically requires a much larger number (usually in the thousands) of iterations to develop a stable distribution of values. What is the basis for limiting this analysis to only 72 iterations?
3. **Section 5.5.2.1 and Appendix A, Air Impact (and the corollary discussion in the DEIS Section 7.6).** We recommend making a stronger argument for using carbon dioxide (CO₂) as a surrogate for emissions reductions for other air pollutants (sulfur dioxide or SO₂, nitrogen oxides or NO_x, and mercury or Hg) in out years. Specifically, it would be helpful to provide additional detail on the underlying assumptions used to estimate emissions in out years. These assumptions are critical to the resulting conclusion that CO₂ can act as a surrogate for emissions reductions for other air pollutants. In addition, it would be helpful to point out that in the IRP Section 5.5.2.1 and Appendix A, the four future "scenarios" are not explicitly displayed (whereas they are in the DEIS, Section 7.6). In other words, the discussion of emission trends in the DEIS shows a more detail view (by breaking out four future "scenarios") than is illustrated in the comparable graphs in the IRP. For the reader, this can cause some confusion, particularly when comparing the CO₂ graphs between the IRP (*i.e.*, Figure A-1) and the DEIS (*i.e.*, 7-6). It is also not clear from the discussion for any pollutant whether the emissions estimated in any year are only direct emissions from sources producing electricity or full life-cycle emissions associated with the production of electricity. An explicit statement to that effect would be helpful. Presumably, they are only direct emissions, although we would encourage TVA to include significant associated indirect emissions as well (*e.g.*, CO₂ emissions associated with processing uranium for nuclear power, criteria pollutant emissions associated with mining, processing, and transporting coal, etc.)
4. **Section 5.5.2.1, Air Impact.** The Final IRP (and FEIS) should explicitly state why this suite of pollutants (SO₂, NO_x, Hg, and CO₂) was selected to represent air pollution issues associated with power generation. The discussion should also

explicitly state why other pollutants (e.g., particulate matter, methane, etc.) are not included in this suite of indicator pollutants.

5. **Figure 7-11, Planning Strategy D.** It is not clear from the discussion whether the CO₂ Footprint in Planning Strategy D includes lifecycle greenhouse gas emissions for nuclear energy. As noted in the DEIS, while nuclear power does not directly emit CO₂, there are life-cycle emissions that can result in CO₂ emissions.⁴ We recommend making an explicit statement in the Final IRP (and FEIS) clarifying the magnitude of the greenhouse gas emissions associated with nuclear power.

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)

General Comment

Other than the mitigation of environmental impacts garnered through *de facto* regulatory implementation and the selection of less CO₂-intensive generation methods in out years, the DEIS does not discuss any other types of mitigation activities that could be implemented to further reduce environmental impacts (e.g., the use of clean diesel options during construction of projects). We recommend that the FEIS discuss, if only generally, that there is a range of such activities that can and will be considered in the development of any given on-the-ground project.

Climate Change

1. **CEQ Draft Guidance on GHG Analysis within NEPA.** On February 18, 2010, CEQ proposed four steps to modernize and reinvigorate NEPA. In particular, CEQ issued draft guidance for public comment on, among other issues, when and how Federal agencies must consider greenhouse gas emissions and climate change in their proposed actions.⁵ The draft guidance explains how Federal agencies should analyze the environmental impacts of greenhouse gas emissions and climate change when they describe the environmental impacts of a proposed action under NEPA. It provides practical tools for agency reporting, including a presumptive threshold of 25,000 metric tons of carbon dioxide equivalent (CO₂e) emissions from the proposed action to trigger a quantitative analysis, and instructs Federal agencies how to assess the effects of climate change on the proposed action and their design. The draft guidance does not apply to land and resource management actions and does not propose to regulate greenhouse gases.

While this guidance is not yet final (and thus, not required), we recommend that both the Final IRP and FEIS explicitly reference the draft guidance, describe the

⁴ Sovacool, BK. Valuing the Greenhouse Gas Emissions for Nuclear Power: A Critical Survey. *Energy Policy* 36 (2008), 2940-2953.

⁵ <http://www.whitehouse.gov/sites/default/files/microsites/ceq/20100218-nepa-consideration-effects-ghg-draft-guidance.pdf>

elements of the draft guidance, and to the relevant extent, provide the assessments suggested by the guidance. For example, DEIS Section 7.6.2 gives only a cursory evaluation of the impact of climate change on the TVA service area and the ability of the various planning scenarios' to supply reliable energy under changing climatic conditions. Likewise, DEIS Section 4 does not discuss to any appreciable extent the impact of climate change on the affected environment (e.g., the impact of climate change on wildlife population trends in the TVA service area). We recommend providing a more in-depth analysis of these points since they constitute a key uncertainty in the overall planning process.

2. **Page 61.** The first paragraph under Table 4-5 references "non-combustion uses of fossil fuels in industrial processes". It would be useful to provide a parenthetical example of such a use.
3. **Page 169 (Table 7-2).** Does the IGCC with CCS value given for CO₂ emissions (108.0 tons/GWh) represent emissions after CCS or prior to CCS? A clarifying footnote would be helpful.
4. **Section 7.3.1, Coal-New Facilities.** This section should include a description of additional air pollutants (only CO₂ is described).
5. **Page 172.** The first paragraph lists a range of:

12 to 61 tons CO₂e/GWh with an average of 22.2 tons CO₂e/GWh

Sovacool (see footnote 4 above) reports a range of:

1.4 grams of CO₂e per kWh (g CO₂e/kWh) to 288 g CO₂e/kWh, with an average value of 66 g CO₂e/kWh

This correlates to a range of:

1.5 tons CO₂e per GWh (t CO₂e/GWh) to 317 t CO₂e/GWh, with an average of 73 t CO₂e/GWh (assuming one ton = 907,185 g)

We recommend TVA re-evaluate the literature to ensure the accuracy of the stated range of values.

6. **Page 176, last paragraph of Section 7.3.3.** This states that "Spath and Mann (2004) calculated a rate of -452 CO₂-eq/GWh for a 60 MW direct-fired boiler using wood waste". The DEIS does not say what the mass units are for the "-452 value" (grams, tons, etc.).

The Spath and Mann citation⁶ provides a value of -410 g CO₂e/kWh for a 600 MW biomass direct-fired reference case. Is this the value that was meant to be

⁶ <http://www.nrel.gov/docs/fv04osti/32575.pdf>

cited? In any event, given this comment and the prior comment, we recommend TVA review and confirm the various values cited from the literature and explicitly clarify what units are being used in the Draft IRP and DEIS, particularly those used for conversions (*e.g.*, the document should state what type of “tons” – American short tons, metric tonnes, etc. – are used in the documents).

Hazardous Air Pollutants (HAPs)

1. **Section 4.3, Air Quality.** We are pleased to see that this section addresses HAPs. Section 4.3 notes that in 2008, TVA emitted approximately 28 million pounds of TRI pollutants, of which acid gases (including the HAPs hydrochloric and hydrofluoric acid) comprise about 99 percent of emissions. The other 1 percent was made up of heavy metals, many of which are also HAPs.
2. **DEIS Summary (Page S-15) and Section 7.6.1, Air Quality (Page 179).** These sections note, “Under all these alternative strategies, there will likely be a substantial beneficial cumulative impact on regional air quality.” Hazardous air pollutants generally have local impacts, so evaluation of their potential impacts should be considered locally rather than regionally. While regional air quality benefits are important, they should not be used to justify or offset increases in local concentrations of HAPs. When TVA considers the potential impacts of a facility, those evaluations should include the potential impacts of HAPs in the vicinity of the facility.
3. **Chapter 7, Anticipated Environmental Impacts.** This chapter seems to focus on criteria air pollutants and greenhouse gases, with minimal mention of hazardous air pollutants. Given the large emissions of HAPs from TVA facilities, they should be addressed in this chapter for the FEIS.

Criteria Air Pollutants

1. **Page S-13.** This page incorrectly states that the only nonattainment area in the TVA region is a few counties in the eastern part of the state (Chattanooga and Knoxville) for PM_{2.5}. In fact, Knoxville is also currently nonattainment for the 1997 8-hr ozone standard, but has clean data and EPA has proposed redesignation to attainment (comment period ends November 8, 2010).
2. **Section 4.3, page 70.** Same comment as above applies for the discussion regarding ozone in the Knoxville area.
3. **Particulate Matter (pp. 70-73).** The document does not discuss the nonattainment status of the Chattanooga and Knoxville areas for PM_{2.5}.
4. **Page 75.** The discussion on lead does not mention that Bristol, TN has a violating monitor for the 2008 lead standard. That area will be designated nonattainment for lead in the next few days.

Editorial Comments

1. **Page 59.** The last part of the last sentence of the first paragraph is broken away from the remainder of the sentence by an intervening paragraph.
2. **Page 186.** Second paragraph, last sentence, last phrase (after the semicolon) seems to be an incomplete statement.
3. **Page 203, Section 7.7.** First sentence appears to be a mistake (the adoption of an alternative strategy has no environmental impacts). All realistic alternative strategies will have some environmental impacts.
4. **Page S-13.** The table key for this summary table could have defined "EEDR" as the "Energy Efficiency and Demand Response", as defined in the DEIS-appended Glossary, Acronyms and Abbreviations (pg. 232).
5. **Pages 158-160.** We note that Tables 6-5 and 6-6 (Strategy C and E) use the heading "Fossil Layups" while Table 6-4 (Strategy B) uses "Coal Layups". Was there an intended difference? Would Strategy C and E also decommission natural gas plants in addition to coal plants?
6. **Page iv.** Tables 6-4 to 6-6 are not listed in the Table of Contents (List of Tables).